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# METHODS OF COLLECTING AND HANDLING COMBINED STRAW

by

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# I N D E X


| | Page |
|---|---|
| Introduction | 3 |
| Factors Influencing the Methods of Straw Handling | 3 |
| Methods of Collecting and Handling Combined Straw | 5 |
| Straw Bunching Equipment | 6 |
| Small bunchers | 6 |
| Trailer-type bunchers | 8 |
| Pickup balers for collecting straw | 16 |
| Straw rack method | 17 |
| Attachment balers for the combine | 18 |
| Summary | 18 |
| References | 19 |

# METHODS OF COLLECTING AND HANDLING COMBINED STRAW

## Introduction

The handling of straw after the combine presents a variety of problems. Straw must be returned to the soil as a much needed source of fibre and plant nutrient. The tillage method used to provide the proper soil condition for decomposition of the straw is a consideration (1). Straw mulch or trash cover is the recognized practice for the prevention of soil erosion by wind and water, and the tillage methods and equipment will influence the degree of protection afforded. Livestock producers require straw for feed and bedding material and are, therefore, presented with the problem of recovering enough straw for their needs.

Cereal crop production is the principal farm business in the short-grass plains area of Western Canada. Diversification in many cases is supplied by livestock raising. Prior to the introduction of the combined harvester-thresher, straw was blown into stacks by stationary threshing machines. This solved the problem of straw collection and storage for these livestock producers. The combine scatters the straw on the fields for improved soil protection and crop production, but creates an added effort for those who require feed and bedding. Even in the early days of the combine, farmers made no attempt to reclaim straw, because many had old thresher stacks of their own, or could purchase these from neighbours still using the binder-thresher method of harvesting (2). Due to the increase in the number of combines, this latter method has almost disappeared from the open plains area.

Recently a very marked increase of interest has been shown in the conservation of combine straw. This interest has been accompanied by demands for some type of equipment, or attachment to the combine, for gathering or bunching the straw into a convenient form for collecting and handling.

## Factors Influencing the Method of Handling Straw

Primarily, straw is used for bedding. The stockman is interested in bulk or quantity of straw, while the poultry raiser wants chaff to provide a dry litter. The operator thus has the problem of choosing equipment that will provide straw to suit either of these purposes. If the straw is to be collected for feed, chaff and grain thrown over must be saved with as little handling as possible from the combine to

the feedlot. When the straw is hauled into a central feedlot, the method of transporting it will influence the manner by which it is bunched. The sweep rake has been in common use for many years as a means of gathering hay from cocks or windrows. Combination sweeps and stackers, mounted on the front of farm tractors, have recently proved very popular for sweeping and transporting hay to the stack. Either of these methods can be adapted to the gathering of straw, provided it is bunched or placed in windrows of convenient size to facilitate quick and easy pickup. Normally, a combination stacker can lift 1,000 to 1,200 pounds of hay. Straw, however, will bulk more and, although extensions can be added to the back of the sweep, the load will not likely be more than 800 pounds.

Where a buncher is not used, a dump rake or side delivery rake can be used to provide cocks or windrows. By using this method to bunch straw, all the chaff, short straw, and loose grain is lost and foreign material such as dirt, sticks, and weeds is introduced into the bunch. Considerations, when deciding on a method of bunching straw, are the availability of hay loaders, slings, grapple hooks, stackers, etc.

Associated with the intended use of straw is the cost. This may be influenced by the number of livestock, the distance hauled to the stack yard, and other factors. If the numbers of livestock are large, acquiring feed is important, and the equipment or method of gathering the straw may be fairly elaborate. As the numbers of livestock decrease, the equipment used can be decreasingly less elaborate or costly. One of the largest items in the cost of putting up feed is the hauling charge. This is due to the labour involved. Studies have indicated that loading loose straw from windrows, hauling and unloading, by hand, is the costliest in labour charge. By the use of power buck rakes or combination stackers, this cost may be reduced as much as 60 per cent. Using hand labour to handle baled straw will cost roughly three-quarters as much as that for loose straw. It is hard to estimate the cost of bunching straw, due to the variations in the type of equipment used. Most bunchers are made at very little expense to the farmer, outside of his own labour. Material is usually readily available from the farm scrap pile. As previously mentioned, the greatest cost comes when reclaiming the straw from the bunches or windrows.

Methods of Collecting and Handling Combined Straw

There are many ways to reclaim straw from the combine. These have been listed by Frank P. Hanson (2). Contact with, or correspondence from farmers who have bunchers or desire to build such equipment, has shown that they favour certain of these methods more than others. When regrouped, these methods fall into the following order of preference.

1. Collecting straw from the combine into bunches of about 75 pounds weight with small bunchers or straw carriers. These bunches are dumped in windrows and reclaimed by:

   (a) Sweeps or combination stackers.
   (b) Loading by hand or hay loaders.
   (c) Sweeps and stationary balers.
   (d) Pickup balers.

2. Bunch the straw with large trailer-type bunchers and reclaim by:

   (a) Sweeps or combination stackers.
   (b) Load by hand.
   (c) Power balers.

3. Pick up straw from the combine windrow with pickup balers.

4. Elevate the straw into racks from the combine with extension elevators.

5. Bale or bundle the straw with the combine baler attachment.

Some other methods have been described by Hanson, and are noted below as a matter of record and interest.

1. Handling straw from the combine windrow by:

   (a) Raking with a dump rake and loading by hand or by hay loader. Unloading at the feedlot by slings or grapple hooks.

   (b) Similar to (a) but chopped and blown into the barn.

(c) Using sweep rakes or combination stackers.

(d) Using sweep rakes and stationary balers.

2. Cut the stubble high with the combine, and mow the standing stubble. Handle as hay.

3. Thresh barged stacks in the feedlot with a combine using extension elevators to stack the straw.

Methods of straw collection described by Gray (3) include cutting high with the combine, followed by mowing, raking with a side delivery rake, and moving the straw to a stationary baler. An alternative method discussed is to cut the stubble low with the combine and elevate the straw and chaff directly into a baler pulled behind the combine.

The above outlines of methods used to collect combine straw may serve to suggest methods and combinations of equipment adaptable to various farm conditions. The methods described in the following pages are the ones in most common use, and will be discussed according to the order of preference indicated in the opening part of this section.

## Straw Bunching Equipment

### Small Bunchers

Two types of small bunchers that illustrate the first straw-saving method are shown in Figures 1 and 2. Figure 1 may be more correctly termed a straw carrier (4), and is probably the most common type of small buncher now in use. It was sold commercially prior to 1927. The construction is very simple and inexpensive, being made of a light wooden frame and canvas sides. A tilting floor dumps the straw on the ground.

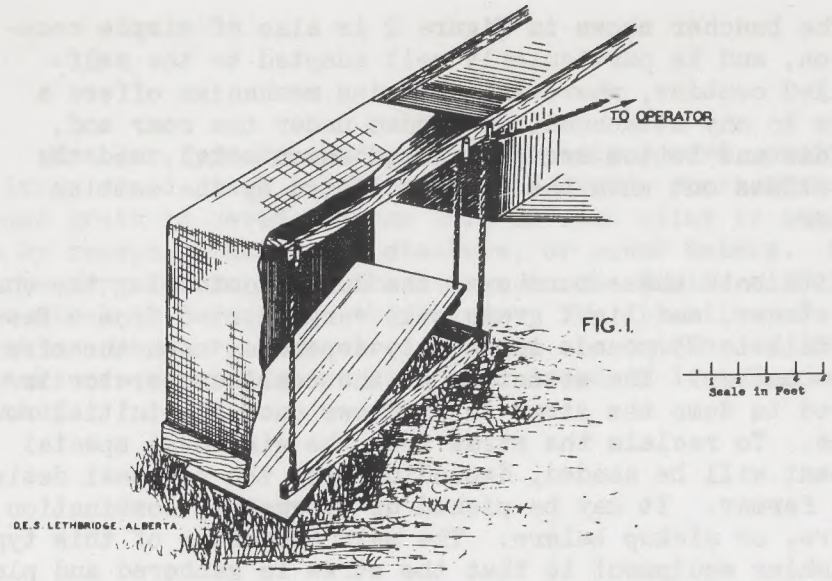
TO OPERATOR
D.E.S. LETHBRIDGE, ALBERTA
Scale in Feet

FIG. I.

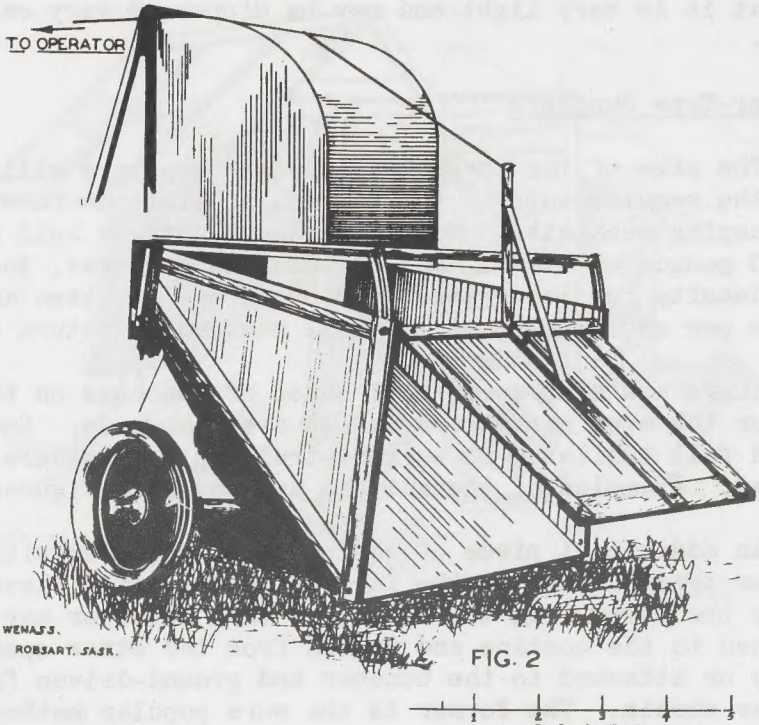
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FIG. 2

The buncher shown in Figure 2 is also of simple construction, and is particularly well adapted to the self-propelled combine, where the steering mechanism offers a problem to any attachment suspended under the rear end. The sides and bottom are galvanized sheet metal, and the straw slides out when the door is lifted by the combine operator.

With both these bunchers, the dumps containing the chaff, short straws, and light grain will vary in size from a few forks full to 75 pounds in weight, depending upon the size of the buncher. The attention of the combine operator is required to dump the straw in windrows once the initial round is made. To reclaim the straw from the windrows, special equipment will be needed, depending upon the personal desired of the farmer. It may be picked up by sweeps, combination stackers, or pickup balers. The main advantage of this type of bunching equipment is that the straw is gathered and placed in windrows, which minimizes the amount of travel made by the pickup equipment. This materially lowers the cost of reclaiming the straw. One disadvantage of this type of windrow is that it is very light and may be dispersed very easily by winds.

Trailer-Type Bunchers

The size of the large trailer-type bunchers will vary with the requirements of the farmer, as will the form, shape, and dumping mechanism. Normally these bunchers hold from 200 to 800 pounds of straw. For calculation purposes, the approximate density for loose straw and chaff may be taken as two pounds per cubic foot, at 10 to 12 per cent moisture content.

There are some commercial makes of bunchers on the market, but for the most part those in use are home-made. Some may be termed full trailers, others semi-trailers, and others semi-mounted. Examples of these types are shown in Figures 3 to 9.

An additional piece of equipment is required with the trailer-type buncher in the form of an extension elevator to convey the straw from the combine. This elevator may be attached to the combine and driven from the straw speader pulley or attached to the buncher and ground-driven from the trailer wheels. The former is the more popular method, because the trailer wheels are often castors.

Trailer-type bunchers, when properly loaded, provide a large sized stack in which all the chaff, short straw, and loose grain is saved. Straw left in such piles is easily up by sweeps, combination stackers, or power balers. Some farmers prefer to leave the stacks in the field, allowing the stock to forage for themselves. The attention of the combine operator is required to dump the bunches so the stacks are of sufficient size and placed in line for easy pickup.

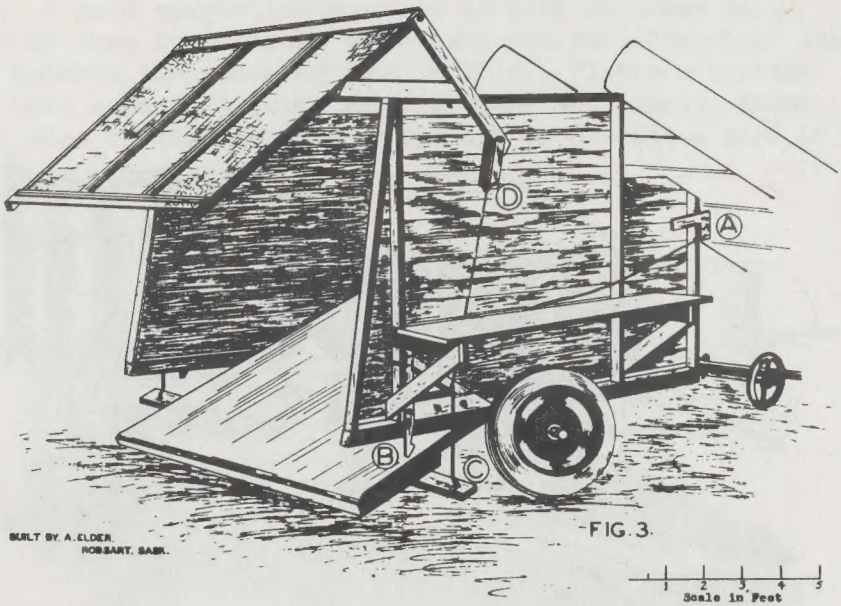


FIG. 3.

The most common type of large trailer-type buncher is the one illustrated in Figure 3. This type finds particular favour with the tractor-drawn models of combines, as hitching arrangements are easy. It may be dumped by the combine operator or by a man riding on the buncher. The one shown is dumped by a rider. When the buncher becomes full, the operator steps on the lever "A", which releases catch "B", and the floor drops under the weight of the straw. The rear door opens due to the linkage "C"-"D" allowing the stack to slide out. The door, made of chicken wire and sacking on a wooden frame, although light in weight, returns the floor to the horizontal position and the trip mechanism engages. The framing for the body is 4 by 4 and 2 by 4-inch material, and the sides sheathed with 1 by 6-inch material. The floor is covered with sheet metal to help the stack slide out. Some models are full trailers with a small pair of trucks for front wheels. These aid materially in stabilizing the buncher and forcing it to follow the combine very closely on corners. Such bunchers can be made to any desired size, the limiting factor being the weight of stack that can be lifted by the sweeps and stackers.

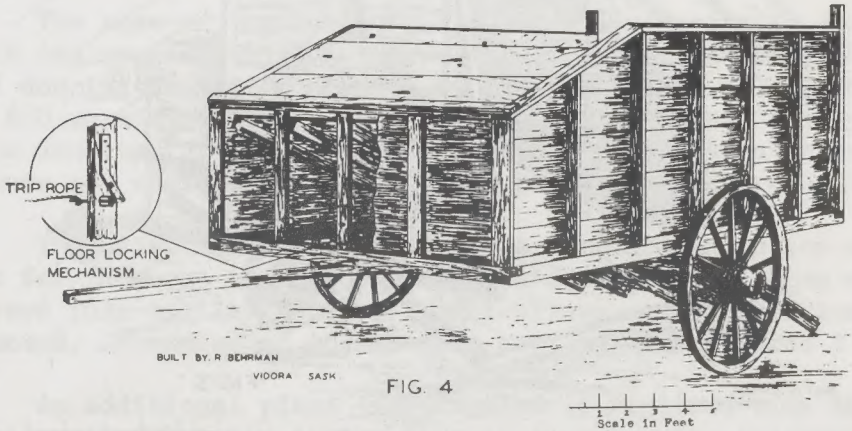


FIG. 4

A very large trailer-type buncher is shown in Figure 4. The mounting of this buncher is somewhat different than other types in that the builder favoured the large wagon wheels to smaller rubber tired wheels. Much of the jolting, due to rough ground and badger holes, can be eliminated by the large wheels. A large single bolster supports the buncher and supplies a pivot point for the floor. Designed to be dumped by the combine operator, the floor is tilted by releasing a catch (see inset Figure 4) at the front of the buncher. A light weight door at the rear opens under the pressure of the stack as the floor tilts and closes when the floor returns to the horizontal position. Inside dimensions measure approximately 7 feet 6 inches wide by 9 feet long by 4 feet high, and provide a stack of about 650 pounds weight. The stack is very compact and contains all the chaff, loose grain, and short straws. Once the initial round has been made in the field with the combine, the stacks can be dumped in line and picked up by the stackers or sweeps, each stack providing an adequate load for the pickup equipment. It will be noted that the construction of this buncher is of very much heavier material than some of the others, to provide for the larger loads. A good suggestion would be to pick up these large stacks as soon as possible to prevent too much "bonding" taking place between the stack and the stubble. Pickup equipment might have some difficulty getting under such large, dense stacks when loading them for transport to the stack yard or feedlot.

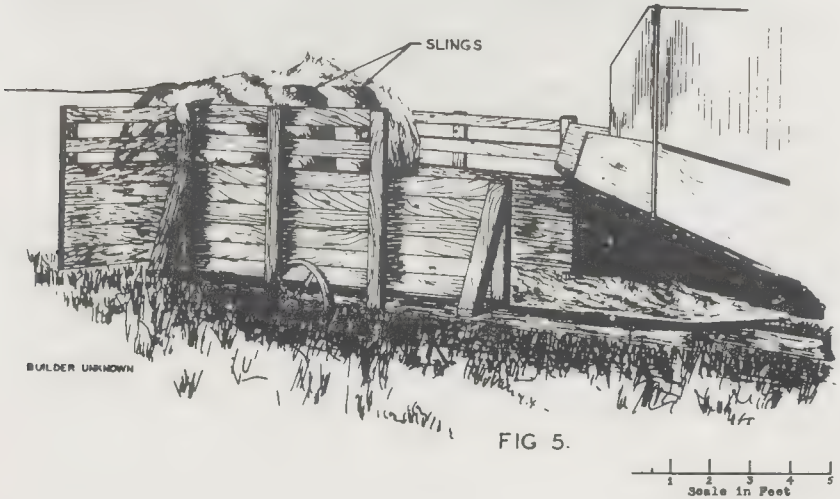


FIG 5.

Figure 5 shows a different style of trailer-type buncher. The straw is placed and tramped as it comes from the combine, and is dumped by opening the back gates and rolling out the stack with slings. The stack formed is very compact, all the chaff and straw being saved. Some combining time is lost, however, because it is necessary to stop the combine in order to dump the stack. Such stacks can be dumped in windrows and gathered by sweeps or combination stackers.

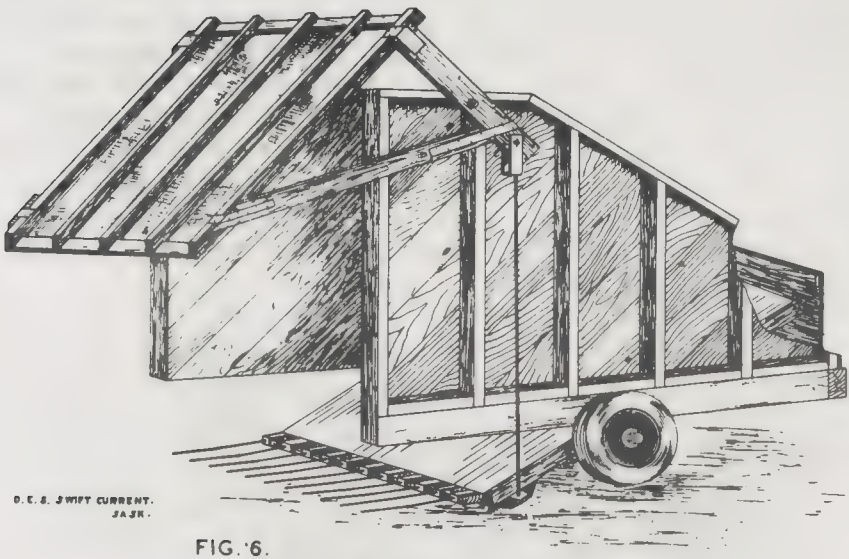


FIG. 6.

Self-dumping bunchers are finding some popularity. Two types are shown in Figures 6 and 7. The buncher shown in Figure 6 is patterned after the header barge, and the dumping mechanism is somewhat similar to the buncher shown in Figure 1. The floor is balanced against the weight of the rear door. When the stack builds up, the weight of straw causes the floor to drop, the rear door opens, and the stack slides out. One particular feature of this buncher is the hinged fingers at the rear of the floor. As the stack touches the ground, the fingers bend allowing the stack to slide to the ground rather than being dropped. The stack remains solid and is not loosened by jarring. This buncher is fairly large and of solid construction. The wheels are castors to provide for good tracking behind the combine.

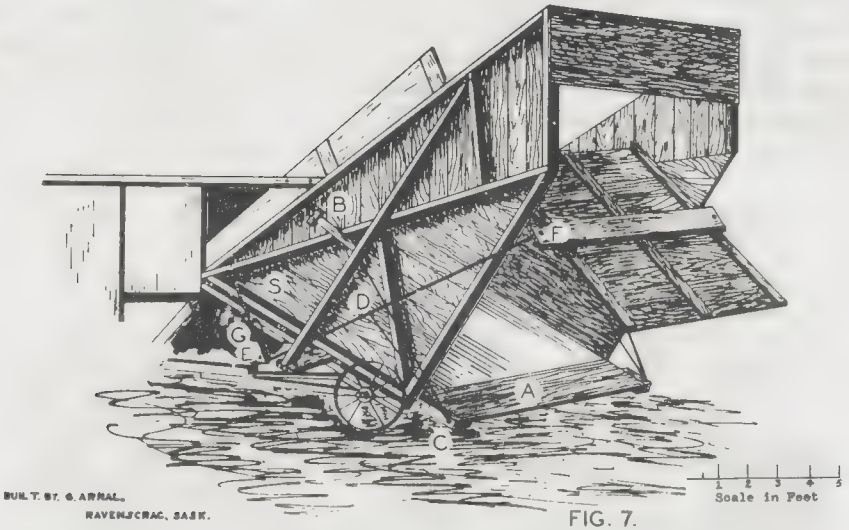


FIG. 7.

The self-dumping buncher shown by Figure 7 is somewhat of a novelty in its construction and operation. The large rear door is held in place against the body of the buncher by the small bottom door "A". As the straw piles up in the buncher, its weight, pressing against the large door, opens the small lower door against the pull of counterweight "B". As the small door opens, a cable "C"-"D", connecting the door to the steel rod "E"-"F", pulls this rod off centre at the linkage "EG" opening the rear door. The stack then slides out. As the weight of the straw is relieved from the small door, the cable "CD" slackens slightly allowing the return spring "S" to pull the rod "EF" back over the centre of the linkage "EG" closing the rear door. The counter weight "B" then closes the small door, and the barge is ready to again collect straw from the combine.

Both the bunchers described above make a very compact stack, which contains the chaff, short straw, and loose grain. The combine operator is not concerned with the dumping mechanism, and can devote his whole time to the combining operations. There is some objections to this type of a buncher in that the stacks are dumped at random over the field. This makes picking up rather awkward, because more time is used going from stack to stack to secure a full load for the sweep or combination stacker.

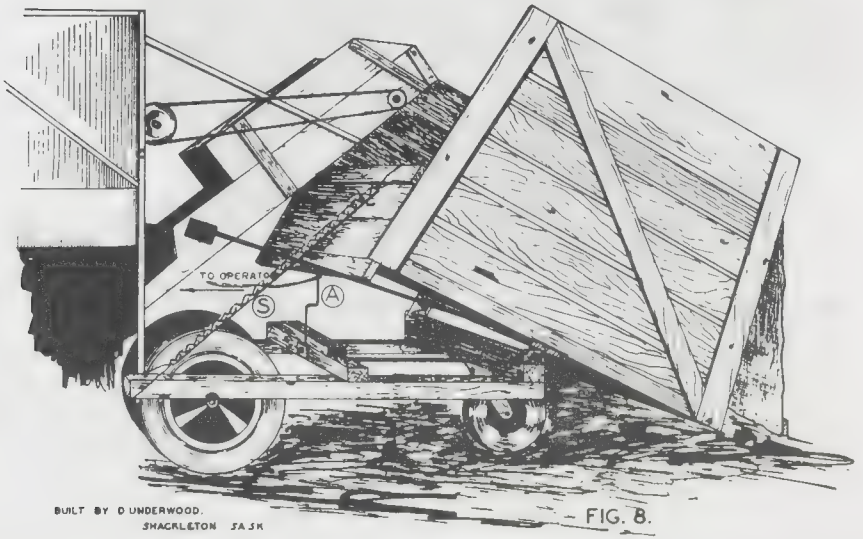


FIG. 8.

The self-propelled combine offers some problems, due to the steering mechanism, when the trailer-type buncher is considered. However, there are adaptations that can be used as shown in Figures 8 and 9. The buncher illustrated in Figure 8 might be termed a semi-mounted buncher in that the trailer is fixed to the rear of the combine by two rigid shafts that can move in the vertical plane only. The buncher is supported by a single castor ground wheel. It will be noticed that the frame or chassis and the body of this attachment are two separate pieces; that is, the body as a whole tilts, being pivoted over the rear cross member of the chassis. Because the body is of light lumber and canvas construction, it tilts easily due to the weight of the straw when the trip lever "A" is released by the combine operator. Return of the body to the horizontal position is accomplished by its weight and a return coil spring "S". The door, made of canvas weighted at the bottom, is suspended from the top rear of the body and opens under the pressure of the straw in the body as it tilts. The dumps made by this buncher are fairly small and may weigh from 150 to 200 pounds. Pickup equipment, such as combination stackers, can conveniently handle six or seven of these dumps. It will be apparent from the drawing that the hood at the rear of the combine has been removed, and the straw falls on the elevator directly from the straw walkers and the chaffer. Some steering difficulties were experienced by the operator of this equipment, particularly in soft soils, due to a drag on the steering mechanism.

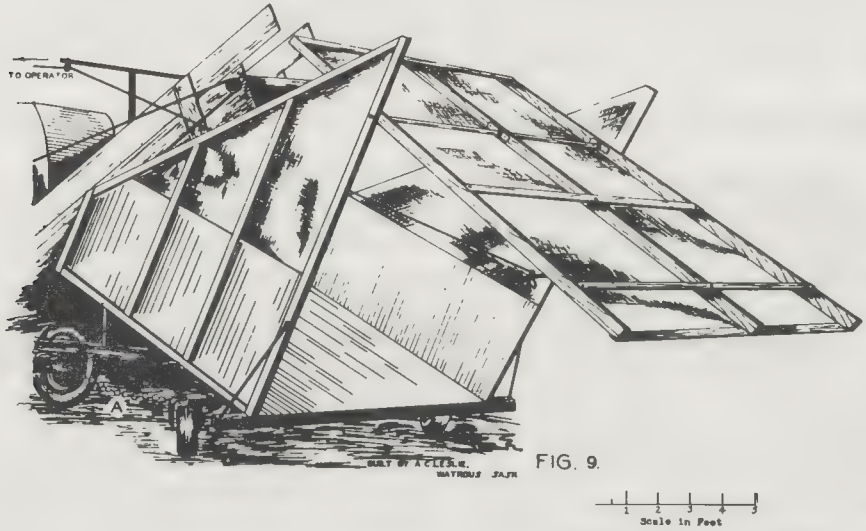


FIG. 9.

Figure 9 shows a semi-trailer-type buncher adapted to the self-propelled combine. Two castor wheels support the machine. In addition to the tongue hitch, two chains, one of which is shown at "A", prevent the buncher from swinging out on corners. The floor and part of the walls are lined with sheet metal. Above the metal, the walls are canvas. To dump the stack, the combine operator releases the rear door which swings open under its own weight. When the stack has been dumped, the door closes and is locked shut by the combine operator. The stack formed is fairly large, being in the neighbourhood of 500 pounds. Two of these stacks should provide a good load for the pickup equipment used.

There are many adaptations of the home-made straw bunchers described above, and others that have not been discussed. The foregoing illustrated some of the bunchers already in existence. Because these machines are home-made, there are no detailed drawings available.

Trailer-type bunchers, or so-called "stackers", are available commercially and a limited number were sold in Western Canada in 1947 and 1948. One employs a canvas conveyor to elevate the material to a dump-type barge. Another unit, designed primarily to collect weed seeds, uses a trough and suction fan to collect part of the chaff, which is blown into a screened or covered rack drawn behind the combine. A modification of this idea might prove serviceable where a small amount of material is required for bedding, in that most of the weed seeds and chaff, and even a part of the straw could be collected, leaving the balance of the straw on the field for trash cover.

## Pickup Balers for Collecting Straw

During the past few years, the pickup baler has become more prominent as a means of reclaiming straw from the combine windrow. The straw is easy to handle in bales when storing or shipping.

Some difficulty may be experienced when picking up straw from the windrow, due to its settlement into the stubble. The operation will be somewhat easier after some weathering has taken place to remove the "slickness" of the straw. It is advisable to put two or more windrows together to minimize the amount of baler travel, and provide a single windrow of sufficient bulk for efficient baler operation. This can easily be

done if the initial harvesting operation is swathing using a combination of swathing equipment. One combination could be a 16-foot centre delivery swather followed by a 12-foot header with an extension elevator, all pulled by one tractor. Another could be a 16-foot centre delivery swather followed by a 16-foot end delivery swather, pulled by one or two tractors. This would provide a double swath 28 to 32 feet wide, which could be handled by combines. A heavy straw swath would result. This, of course, would not be possible where the straw is rank or heavy, as the combine may not be able to handle such a large swath. Single combine windrows can be brought together with a side delivery rake. Much of the chaff, short straw, and loose grain is lost, however, and foreign material, such as dirt and weeds is introduced into the swath.

Baling is a very convenient way of placing straw in a bundle that is easy to handle. However, baling is relatively expensive. The bales must be picked up from the field, usually by hand, loaded, transported, and unloaded at the stack. This cost may be as much as one-third of the total cost of the straw in the stack. If baled straw increases the efficiency of the feeding program by convenience and ease of handling, then the extra cost of baling may be warranted.

The cost of baling straw per ton will be relatively high compared with hay. Low yields, of seldom more than one-half ton per acre, and the distance of baler travel, are the main reasons for the high cost. It will be difficult, when picking up straw with the baler, to collect the loose grain and chaff, particularly if the straw has settled into the stubble.

Straw Rack Method

This method of reclaiming straw is not commonly used. It is, however, one of the simplest methods and requires very little additional equipment. An extension elevator is required to convey the straw from the rear of the combine to a straw rack pulled to one side or directly behind the combine. The rack can be fitted with ropes or slings for unloading at the barn or feedlot.

Straw handled in this way will contain all of the chaff, loose grain, and short straw. It is necessary, of course, to stop the combine while the full rack is removed and an empty one attached, unless the rack is pulled by an additional

tractor. This method requires more labour and equipment, which will increase the cost of reclaiming straw.

Attachment Balers for the Combine

A baler attachment for the combine would appear to offer an attractive solution to the problem of reclaiming combined straw. As yet, however, only loose-tying or bundling mechanisms have been tried commercially. These have not proven entirely satisfactory, due to the difficulty of mounting the additional weight of the mechanism on the frame of existing combines, reduction in daily capacity of the combine, and some loss of chaff from loosely-tied bundles. The collection of the bundles is comparable to handling unstooked sheaves. One type of bundler, sold in the United States in 1940, employed packers and a single binder knotter, another employed an auger to compress the straw and twin binder knotters. In England, some combine manufacturers have incorporated a bundler into their combine design, while others have made it a separate attachment. More recently a bundler, of German origin, has been adapted to a British-made combine.

At present, there are no commercially-made combine attachments that will tie a standard compressed bale similar to a field baler. As an alternative, and where it is desired to save the chaff, an engine-powered twine or wire tying automatic field baler may be hauled behind the combine and the straw and chaff elevated directly to the baler.

Summary

Straw reclaiming equipment is needed in many areas, as has been indicated by correspondence received during the past few years. These requests have been, in the main, for plans of attachable equipment, although some have been directed toward the baling of straw.

This material has been prepared to bring together available information on methods of reclaiming straw. From this collection of ideas and designs, it is hoped that the individual farmer may be able to adapt one idea, or a combination of several, to suit his particular requirements. Since the materials and equipment on every farm are different, no attempt has been made to show complete details of construction.

Bunchers should be kept as light as possible, and yet have sufficient strength to stand up to rough field conditions. For the most part, those shown have been made of rough lumber and canvas, the heavy materials being used for the chassis and frame only. From the point of view of draft, such equipment will naturally pull lighter if roller bearing mounted, rubber-tired wheels are used. Some operators prefer the larger diameter wheels in an attempt to avoid jolting and jarring of equipment.

Commercially-made bunchers or "stackers" are becoming available, and appear to be giving a satisfactory performance with both the pull type and self-propelled combines.

Loose-tying, or bundling, attachments for the combine have been made commercially but have not proven entirely satisfactory. Baling with the automatic field baler, used either as a pickup baler for windrows or fed directly from the combine, is a convenient method of packaging straw for handling. Where straw must be hauled some distance and re-handled several times to the barn or feedlot, the cost of baling may be warranted.

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